On the Magnetic Moment of the Residual Magnetism of the Rock.

著者	Kato Yoshio
雑誌名	Science reports of the Tohoku University. Ser. 5, Geophysics
巻	3
号	1
ページ	45-47
発行年	1951-04
URL	http://hdl.handle.net/10097/44456

ON THE MAGNETIC MOMENT OF THE RESIDUAL MAGNETISM OF THE ROCK

Yoshio KATO

Institute of Geophysics, Faculty of Science, Tôhoku University

(Received October 26, 1950)

The author observed the magnetic susceptibility, the direction of the residual magnetism and the intensity of magnetization of many volcanic rocks collected from Izu District.

The author investigated first the relation between the value of the susceptibility of the rock and amount of the magnetite in the sample.

The normative amounts of the magnetite in the sample used in this experiment are calculated by the chemical analysis.

It is naturally considered that the ferromagnetic substance contained in the rock is magnetite, but we cannot know whether this magnetite exists in the state of pure crystal or a solid solution. If the magnetite exists in the state of pure crystal in the rock, we can calculate the apparent susceptibility of the rock itself, under the assumption that the magnetite is contained in the form of sphere. For example pumice of Mt. Koma-ga-dake, Hokkaidô, contains magnetite in the pure state, also the value of susceptibility is coincides absolutely to the calculated value. If the magnetite exists in the state of a solid solution in the rock, the value of the susceptibility of the rock is less than the calculated value.

Fig. 1 shows the relation between the

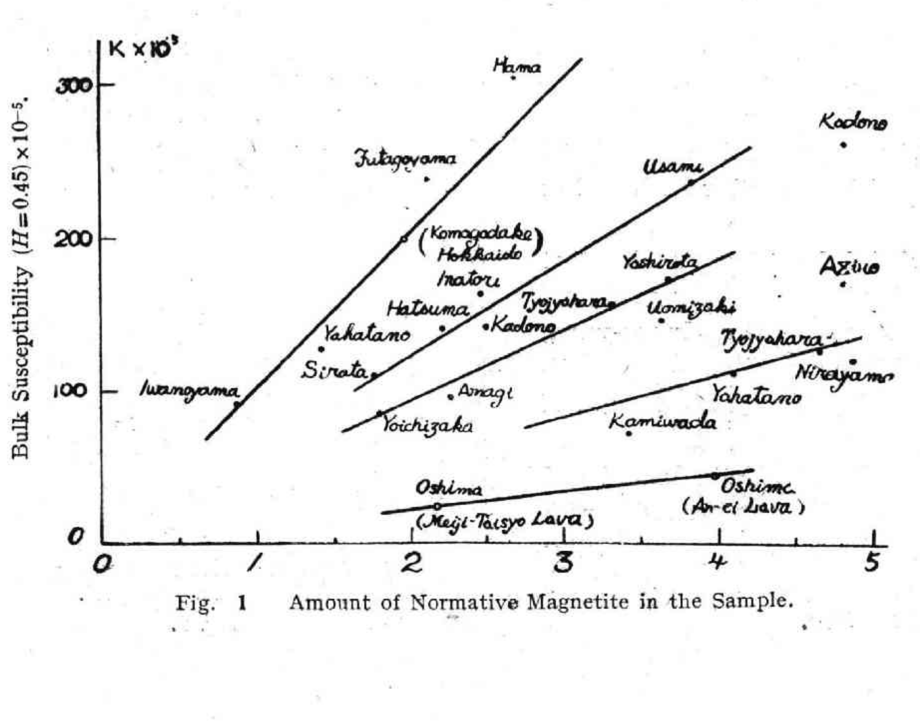


Fig. 1 Amount of Normative Magnetite in the Sample.

Table I. Specific Susceptibiliy of Rock from Izu District.

	Volume c.c.	Weight gr.	Density	Specific Susceptibility ($H=0.45$) $\times 10^{-5}$	Bulk Susceptibility ($H=0.45$) $\times 10^{-5}$	Amount of Normative Magnetite in the Sample.gr.
Pliocene Effusive Rocks						
Usami	38.31	68.82	1.7964	133.0	239.0	3.82
Shirata	39.58	58.85	1.4823	71.3	110.6	1.76
Minor Tertiary Intrusive Rocks						
Kadono	39.58	62.97	1.5920	166.2	264.5	4.80
Amagi-tôge	39.58	65.37	1.6516	58.1	96.0	2.27
Kadono	48.45	63.21	1.6640	86.1	141.5	2·50
Hama	37.36	64.20	1.7184	177.5	305.0	2.67
Lower-Pleistocene Rocks						
Ajiro	39.01	73.02	1.8718	91.8	171.8	4.81
Quaternary Rocks						
1) Amagi Volcano						
Yoichisaka	38.31	70.50	1.8403	38.2	84.5	1.80
Yahatano	38.45	70.87	1.8432	61.0	112.5	4.10
〃	37.14	61.02	1.6884	75.8	128.0	1.42
Inatori	34.09	55.97	1.6418	99·3	163.0	2.45
Hatsuma	34.09	56.15	1.6471	67.6	111.4	2.21
Iwano-yama	39.72	58.64	1.4763	61.9	91.4	0.88
2) Hakone Volcano						
Futagoyama	36.14	55.24	1.5285	157.0	240.0	2.10
3) Usami Volcano						
Chôjahara	39.72	71.72	1.8056	85.1	157.5	3.32
〃	37.36	69.12	1.8501	70.9	128.0	4.65
4) Taga Volcano						
Uomisaki	36.43	60.17	1.6449	89.4	147.5	3.63
Nirayama	39.12	77.44	1.9796	60.9	120.9	4.85
Kamiwada	37.36	67.31	1.8016	39.7	71.5	3.42
5) Omuroyama Volcano						
Yashirota	—	72.33	—	94.4	174.5	3.67
Kawana	39.72	64.54	1.6294	81.5	132.5	1.65

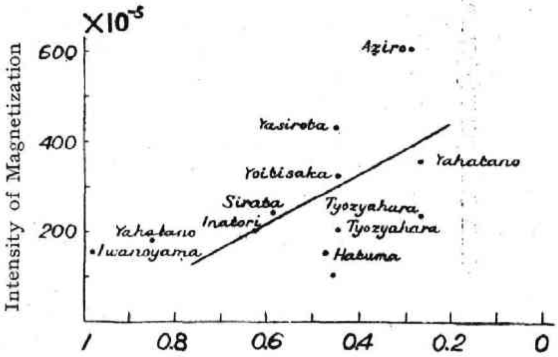
observed value of the susceptibility of the rock (which is given in the ordinate) and the normative amounts of the magnetite contained in that rock (given in the abscissa).

As the figure shows, the rocks of Koma-ga-dake, Iwanoyama, Futago-yama, and Hama form one straight line, while those of Shirata, Inatori and Usami form another straight line and so on.

It is concluded from these results, that the magnetite exists in the state of pure crystal in the rock of Koma-ga-dake, Iwano-yama, Futagoyama and Hama, and that the susceptibility of the rock depends on the amount of magnetite.

But in the rock of the Sirata, Inatori and Usami the magnetite exists in solid solution with other materials, and the value of susceptibility of these rocks depend on this magnetite in the state of a solid solution.

The susceptibility of a ferromagnetic substance becomes less if it forms a solid solution with another paramagnetic substance, and it decreases its value gradually with the increasing of amounts of these para- or diamagnetic substances. Now next the author observed the direction of the permanent magnetism and the



Ratio of the Observed Value of Susceptibility to the Calculated one. Obs/Cal.

Fig. 2.

Table II.

Stations Where the Sample is Collected	Susceptibility		Ratio of Obs./Cal.	Intensity of Remanent Magnetization $\times 10^{-5}$ e.m.u.
	Calculated Value	Observed Value		
Usami	403	239.0	0.59	—
Shirata	187	110.6	0.59	248
Kadono	507	264.5	0.52	—
〃	266	141.5	0.53	—
Amagi-tôge	241	96.0	0.40	—
Hama	284	305.0	1.08	—
Ajiro	508	171.8	0.34	616
Yoichizaka	192	84.5	0.44	323
Yahatano	434	112.5	0.26	363
〃	150	128.0	0.85	181
Inatori	261	163.0	0.62	202
Hatsuma	235	111.4	0.48	153
Iwano-yama	94	91.4	0.98	157
Futagoyama	224	240.0	1.07	—
Chôjahara	351	157.5	0.45	203
〃	491	128.0	0.26	240
Uomizaki	384	147.5	0.38	—
Nirayama	511	120.9	0.24	—
Kamiwada	363	71.5	0.20	—
Yashirota	389	174.5	0.45	435
Kawana	176	132.5	0.75	—
Koma-ga-dake	208	207.5	1.00	—
Oshima	423	48.8	0.12	—
Oshima	224	26.5	0.12	—

intensity of magnetization of these rocks, and found that the intensity of magnetization of the rock increases its value when the magnetite contained in the rock exists in the state of solid solution.

Fig. 2 shows the relation between the observed value of intensity of magnetization (which is given in ordinate) and the ratio of the observed value to the calculated value of susceptibility of the rock (which is given in the abscissa).

As the figure shows the value of the intensity of magnetization becomes great if the ratio becomes small, that is the intensity of magnetization of the rock becomes great if the magnetite contains in the rock exists in the state of solid solution.